

**Notice of Allowability**

Application No.

10/783,124

Examiner

Kuen S. Lu

Applicant(s)

STEENSGAARD ET AL.

Art Unit

2167

**-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--**

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to RCE filed 3/8/2007.
2. ☒ The allowed claim(s) is/are 12-15 and 17-24 (renumbered to 1-12).
3. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some\* c) ☐ None of the:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

\* Certified copies not received: \_\_\_\_\_.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.

**THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.**

4. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.
5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
- (a) ☐ including changes required by the Notice of Draftsperson's Patent Drawing Review (PTO-948) attached
- 1) ☐ hereto or 2) ☐ to Paper No./Mail Date \_\_\_\_\_.
- (b) ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date \_\_\_\_\_.
- Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).
6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

**Attachment(s)**

1. ☒ Notice of References Cited (PTO-892)
2. ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3. ☐ Information Disclosure Statements (PTO/SB/08),  
Paper No./Mail Date \_\_\_\_\_
4. ☐ Examiner's Comment Regarding Requirement for Deposit  
of Biological Material
5. ☐ Notice of Informal Patent Application
6. ☒ Interview Summary (PTO-413),  
Paper No./Mail Date 6/4/2007.
7. ☒ Examiner's Amendment/Comment
8. ☐ Examiner's Statement of Reasons for Allowance
9. ☐ Other \_\_\_\_\_.

## **DETAILED ACTION**

### ***Continued Examination Under 37 CFR 1.114***

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on February 27, 2007 has been entered.

2.1. This action is responsive to Applicant's RCE filed April 10, 2007. It is acknowledged that claims 12-13 and 17-18 were amended, claims 21-22 and 23-24 were newly added and claims 1-11 and 16 were canceled. Examiner's rejection to claim 1 under 35 U.S.C. 112, 2<sup>nd</sup> Paragraph is hereby withdrawn, as necessitated by the Amendment.

2.2. After a thorough search and examination of the present application, and in light of the prior art made of record, Applicant's Amendment and Remarks filed February 27, 2007 and Examiner's amendments made on June 4, 2007, Claims 12-15 and 17-24 (renumbered to 1-12) are allowed.

### ***Examiner's Amendments***

3. Authorization for this Examiner's amendment, listed below, was given in telephone interview with Applicant; Mr. Stephen A. Wight (Registration 37,759) on June 4, 2007 for amending claims 12-13, 17-18, 21 and 23. The summary of interview conducted on June 4, 2007 is attached.

3.1. Please amend Claims 12-13, 17-18, 21 and 23 as follow:

12. (Currently Amended) A method for compiling an object-oriented program, the program ~~configured to be~~ executed in a system employing region-based memory management and the method comprising:

- receiving source code for an object-oriented program;

- performing a points-to analysis on the source code to develop at least one shape graph for the program;

- adding instrumentation to the program, the instrumentation configured:

  - to cause objects to be created in regions based on information in the shape graph and

  - to cause deletion of all objects in a region when a determination is made that no objects in the region are referenced by any fields outside the region;

- compiling the program to produce executable code for the program; and

- storing the executable code in a computer-readable storage medium;

- wherein performing a points-to analysis comprises:

  - creating alias sets for parameters based on statements contained in the methods of the object-oriented program;

  - unifying the alias sets based on statements contained in the methods of the program;

creating at least one shape graph with nodes defined by alias sets and edges defined by field mappings between alias sets; and  
associating the nodes of the shape graph with potential memory regions.

13. (Currently Amended) A method for compiling an object-oriented program, the program ~~configured to be~~ executed in a system employing region-based memory management and the method comprising:

receiving source code for an object-oriented program;

performing a points-to analysis on the source code to develop at least one shape graph for the program;

adding instrumentation to the program, the instrumentation configured:

to cause objects to be created in regions based on information in the shape graph; and

to cause deletion of all objects in a region when a determination is made that no objects in the region are referenced by any fields outside the region;

compiling the program to produce executable code for the program; and

storing the executable code in a computer-readable storage medium;

wherein the added instrumentation at least in part comprises:

region-creation code which creates a region given a shape graph;

object-allocation code which, given a region and object information, allocates an object within certain region; and

region-lookup code which, given a region and an identifier of a field, identifies the region referenced by that field.

17. (Currently Amended) A computer-readable storage medium containing instructions, ~~which, when~~ executed, to cause a computer to compile an object-oriented program ~~to be~~ executed in a system employing region-based memory management by performing the following process:

- receiving source code for an object-oriented program;

- performing a-points-to analysis on the source code to develop at least one shape[[-]] graph template for the program;

- adding instrumentation to the program, the instrumentation configured:

  - to cause objects to be created in regions based on the shape[[-]] graph template; and

  - to cause deletion of all objects in a region when a determination is made that no objects in the region are referenced by any objects outside the region; and

- compiling the program;

  - wherein performing a points-to analysis comprises:

  - creating alias sets for parameters based on statements contained in the methods of the object-oriented program;

  - unifying the alias sets based on statements contained in the methods of the program;

creating at least one shape graph with nodes defined by alias sets and edges defined by field mapping between alias sets; and  
associating the nodes of the shape graph with potential memory regions.

18. (Currently Amended) The computer-readable storage medium of claim 17, wherein the added instrumentation at least in part comprises:  
region-creation code which creates a region given a shape[[-]] graph; object-allocation code which given a region and object information, allocates an object within certain region; and region-lookup code which, given a region and an identifier of a field, identifies the region referenced by that field.

21. (Currently Amended) The method of claim 12, wherein each region has a shape[[-]] graph associated with it and each shape[[-]] graph is stored along with the regions it is associated with.

23. (Currently Amended) The computer-readable medium of claim 17, wherein each region has a shape[[-]] graph associated with it and each shape[[-]] graph is stored along with the regions it is associated with.

### ***Reasons For Allowance***

4. The following is an examiner's statement of reasons for allowance:

In Examiner's current action of 35 U.S.C. §102(b) non-Final Rejection for the instant application as described above is based on reference Mellender et al.: "OBJECT-ORIENTED, LOGIC, AND DATABASE PROGRAMMING TOOL WITH GARBAGE COLLECTION", U.S. Patent No. 4,989,132, issued January 29, 1991.

The Mellender reference provides an object oriented programming tool that integrates object-oriented and logic programming, database facilities and an improved garbage collector that employs a concept of regions garbage collection.

The Mellender reference teaches partitioning memory in regions and providing shape graph describing relations between regions, objects in regions and identifying target object by using shape graph information.

However, Mellender reference does not teach the combined subject matter of "creating shape graph defined by parameter alias sets which are created and unified based on object-oriented program statements; and associating shape graph with memory regions" or "creating region, given a shape graph; allocating object within region, given an object and a region; and identifying region reference, given region and identifier", as described in each of the independent claims 12, 13 and 17.

After a thorough search for the prior art conducted on EAST database and domains (NPL-ACM, Google, NPL-IEEE), and a detailed examination of the search results, Examiner is convinced that the prior art searched and made of record does not teach **the combined subject matter of further combining partitioning memory in regions**

**and providing shape graph describing relations between regions, objects in regions and identifying target object by using shape graph information with the subject matter of “creating shape graph defined by parameter alias sets which are created and unified based on object-oriented program statements; and associating shape graph with memory regions” or “creating region, given a shape graph; allocating object within region, given an object and a region; and identifying region reference, given region and identifier”.**

After further consideration of Applicant's and Examiner's amendments made to the claims, Examiner is persuaded that the mostly recently amended claims 12, 13 and 17 where the combined subject matter as **highlighted above** and described in each of independent claims 12, 13 and 17 is distinct from prior art cited.

An updated search for the prior art on EAST database and on domains (NPL-ACM, Google, NPL-IEEE) has been conducted. The prior art searched and investigated in the database and domains does not fairly teach or suggest the teaching of the newly amended claimed subject matter as combined and described in each of the independent claims 12, 13 and 17.

The dependent claim(s) in the groups (21), (22) and (18-20 and 23-24), depending directly or indirectly upon claims 12, 13 and 17, respectively, are also distinct from the prior art for the same reason.



5. Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

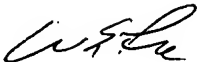
***Contact Information***

6. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Kuen S. Lu whose telephone number is (571) 272-4114. The examiner can normally be reached on Monday-Friday (8:00 am-5:00 pm). If attempts to reach the examiner by telephone are unsuccessful, the examiner's Supervisor, John Cottingham can be reached on (571) 272-7079. The fax phone number for the organization where this application or proceeding is assigned is 703-305-3900.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for Page 13, published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 703-305-3900 (toll free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, please call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

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Kuen S. Lu, 

Patent Examiner, Art Unit 2167

June 6, 2007